

01FN046US

**AFTER FINAL: EXPEDITED ACTION**

02230028aa

Amendment dated 02/01/2005

Reply to office action mailed 12/15/2004

The following is a complete listing of all claims in the application, with an indication of the status of each:

**Listing of claims:**

- 1           1. (currently amended) A magneto-resistance effect element comprising:
  - 2                   a lower conductive layer;
  - 3                   a free layer provided on the lower conductive layer and having an
  - 4                   orientation of magnetization varied by a magnetic field applied thereto, said
  - 5                   free layer thereby acting as a magnetic sensing layer changing the orientation
  - 6                   of magnetization in accordance with the direction and magnitude of the
  - 7                   magnetic field;
  - 8                   a non-magnetic layer provided on top of the free layer;
  - 9                   a fixed layer provided on the non-magnetic layer and having a pinned
  - 10                  orientation of magnetization;
  - 11                  a vertical bias layer, provided on said lower conductive layer and not
  - 12                  underneath said non-magnetic layer, for applying a magnetic field to said free
  - 13                  layer, said free layer being patterned to make an end portion thereof overlap
  - 14                  that of said vertical bias layer, and said free layer is greater in length in the
  - 15                  direction of a magnetic field applied thereto by said vertical bias layer than
  - 16                  said fixed layer, and a sense current for detecting a change in electrical
  - 17                  resistance of said non-magnetic layer flows substantially in perpendicular
  - 18                  relation to said non-magnetic layer, and
  - 19                  an underlying layer for said free layer provided under said free layer,
  - 20                  and said underlying layer for said free layer being provided on said vertical
  - 21                  bias layer and extending on said vertical bias layer beyond said overlapping
  - 22                  portion of said free layer being in contact with said free layer and said vertical
  - 23                  bias layer, and said lower conductive layer.

01FN046US

**AFTER FINAL: EXPEDITED ACTION**

02230028aa

Amendment dated 02/01/2005

Reply to office action mailed 12/15/2004

- 1        2. (original) The magneto-resistance effect element according to claim 1,  
2        wherein said lower conductive layer has a recessed portion on an upper  
3        surface thereof, and said vertical bias layer is provided so as to allow at least  
4        part thereof to be buried in said recessed portion.
- 1        3. (canceled)
- 1        4. (canceled)
- 1        5. (previously presented) The magneto-resistance effect element according to  
2        claim 1, further comprising a vertical bias layer protective layer provided on  
3        said vertical bias layer, and said vertical bias layer protective layer being in  
4        contact with said vertical bias layer, and said vertical bias layer protective  
5        layer being in contact with at least one of said free layer and said underlying  
6        layer for said free layer.
- 1        6. (currently amended) A magneto-resistance effect element comprising:  
2                a lower conductive layer;  
3                ~~a magnetic layer provided on the lower conductive layer;~~  
4                a free layer provided on the magnetic layer and having an orientation  
5        of magnetization varied by a magnetic field ~~coupled magnetically to the~~  
6        ~~magnetic layer and~~ applied thereto;  
7                a non-magnetic layer provided on the free layer;  
8                a fixed layer provided on the non-magnetic layer and having a pinned  
9        orientation of magnetization; and  
10               a vertical bias layer, provided on said lower conductive layer and not  
11        underneath said non-magnetic layer, for applying a magnetic field to said free

01FN046US

**AFTER FINAL: EXPEDITED ACTION**

02230028aa

Amendment dated 02/01/2005

Reply to office action mailed 12/15/2004

12 layer, said free layer being patterned to make an end portion thereof overlap  
13 that of said vertical bias layer, and said ~~magnetic-free~~ layer is greater in length  
14 in the direction of a magnetic field applied thereto by said vertical bias layer  
15 than said ~~free-fixed~~ layer, and a sense current for detecting a change in  
16 electrical resistance of said non-magnetic layer flows substantially in  
17 perpendicular relation to said non-magnetic layer, and  
18 an underlying layer for said vertical bias layer, wherein said vertical  
19 bias layer is provided so as to allow at least part thereof to be buried in a  
20 recessed portion on an upper surface of said lower conductive layer so as to  
21 provide a gradual slope to an end portion of said underlying layer for said  
22 vertical bias layer  
23 ~~wherein said magnetic layer is in contact with said free layer and said~~  
24 ~~vertical bias layer.~~

1 7. (canceled)

1 8. (original) The magneto-resistance effect element according to claim 6,  
2 wherein said lower conductive layer has a recessed portion on an upper  
3 surface thereof, and said vertical bias layer is provided so as to allow at least  
4 part thereof to be buried in said recessed portion.

1 9. (canceled)

Claims 10-63. (canceled).